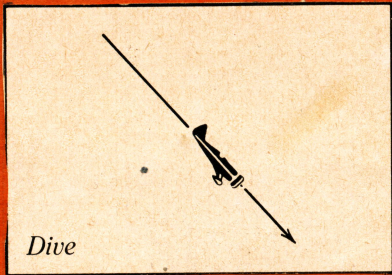


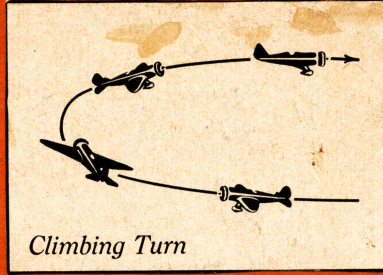
ACROBATIC FLYING

BY

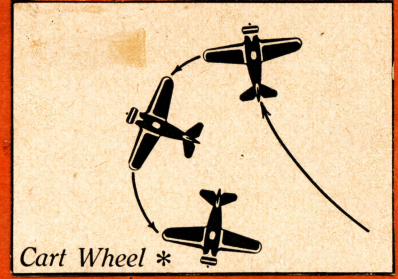
MACKENZIE
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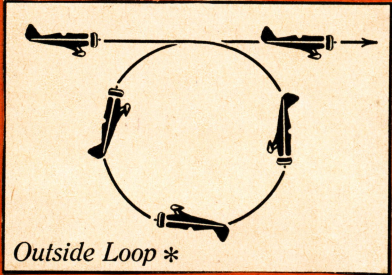
Dive



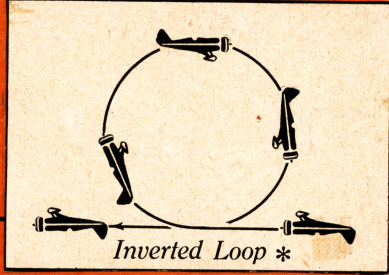
Climbing Turn



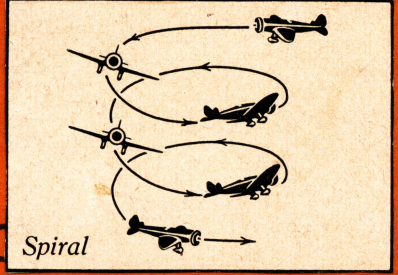
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Outside Loop *

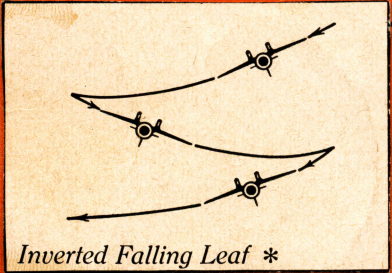


Inverted Loop *

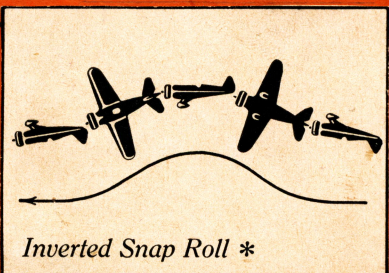


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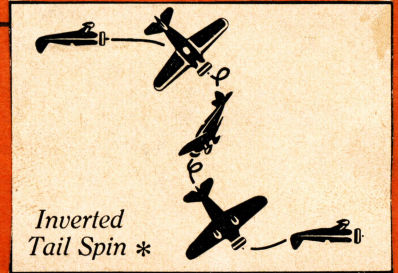
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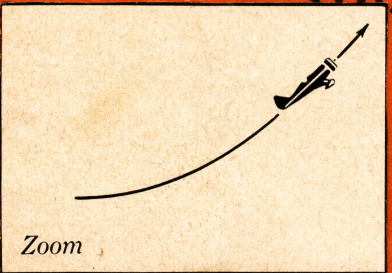
Inverted Falling Leaf *



Inverted Snap Roll *



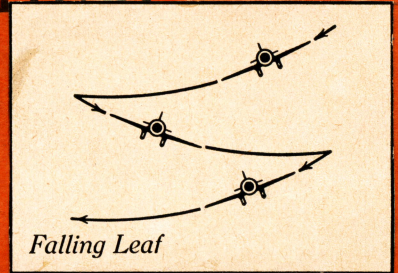
Inverted Tail Spin *



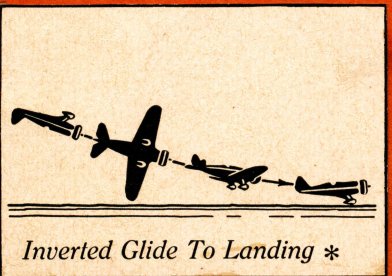
Zoom



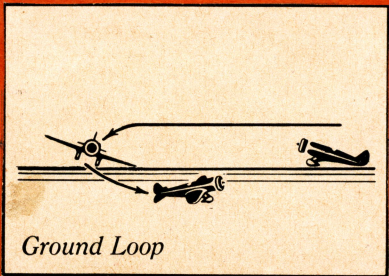
Fish Tailing



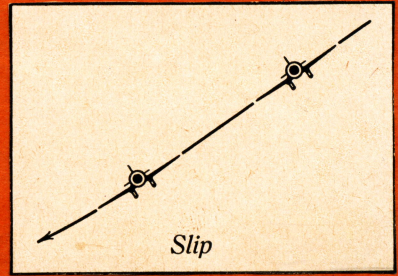
Falling Leaf



Inverted Glide To Landing *



Ground Loop



Slip

TRI-STATE COLLEGE

OUTLINES AND MANUSCRIPTS

LABORATORY NOTES

Q

An impersonal
discussion rather than giving
of directions is perhaps a better
style of reports of this type.
The material is interesting, and
the layout and display are
excellent.

ACROBATIC FLYING

by

MacKenzie C. Patterson

Commercial 37248

Preface

It has been the pleasure of the writer of this report to put the theory of a few of the basic acrobatic maneuvers into as simple language as possible, because it is a subject which is neglected by the majority of airplane pilots. No pilot is justified in neglecting to include acrobatics in his flying career. Neither is any pilot sufficiently well informed without such knowledge. However, there is among some pilots, a grim determination to be little the importance of acrobatics. If the readers of this report will study it, there is a fine chance that they will not only be better flyers, but will never regret the investment of their time in the interests of sensible flying.

Sincerely,

MacKenzie C. Patterson

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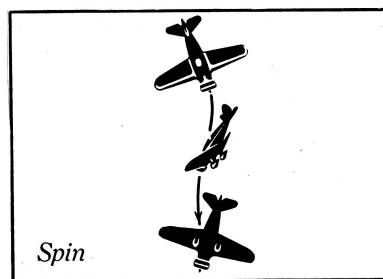
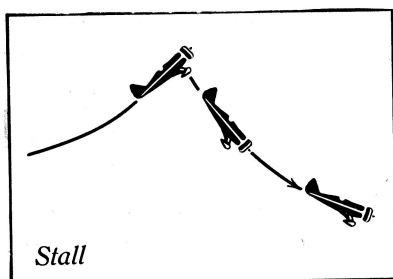
Introduction

The acrobatic maneuvers found in this report are, in the opinion of the author, the foundation for all acrobatic maneuvers. Before attempting to ^{explain} ~~do~~ any of these maneuvers, the author wishes to make as clear as possible the following: Be sure the ship you are about to fly is stressed for acrobatic flying. Know that the ship has been thoroughly inspected. Wear a good parachute. (One that has been repacked with in the last sixty days.) Practice all maneuvers between four and six thousand feet above the ground. Think out each maneuver on the ground before attempting to try it on the ^{spur} ~~spirit~~ of the moment. You know if you are in a physical condition to be flying, fly accordingly. If you dislike acrobatics and are the least bit unsure of yourself, stay on the ground. Last of all, remember an airplane is a piece of machinery, and you can't fool it at any time.

The Tail Spin

Write subject of section into sentence.

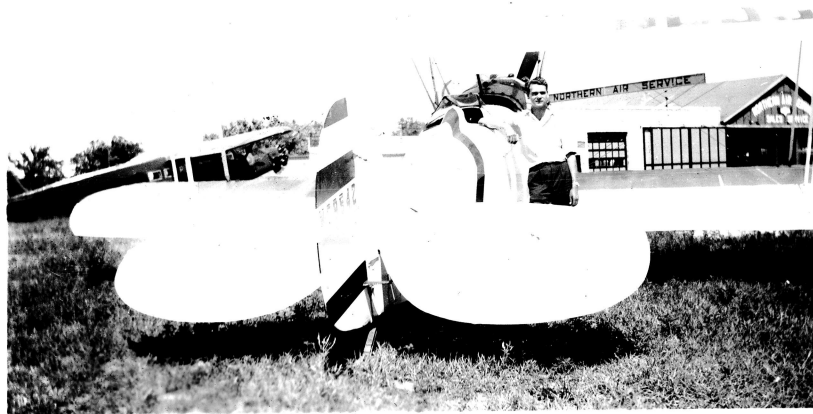
Line up the ship with some object such as a road; close the throttle all the way; pull back slowly on the control column in order to lose all flying speed; wait until the nose of the ship tends to drop slightly; at this time pull the control column all the way back and apply full rudder in the direction the spin is desired; hold the stick all the way back and keep full pressure on the rudder; to recover, apply opposite rudder and push the control column all the way forward until the ship stops spinning; neutralize the controls and assume a dive for a short period; pull back on the control column smoothly and assume normal flight.



It is not advisable to attempt to do more than one or two turns of a spin for the first trial. It is not necessary to jerk the controls at any time during this maneuver, because it places excess strain on the ship. There is only one real danger the novice should watch out for while spinning an airplane, and that is: Should the nose of the ship start to creep up toward the horizon

after the spin has been in rotation for one turn or more, recover immediately, because the particular airplane is going into a flat spin and is seldom recoverable.

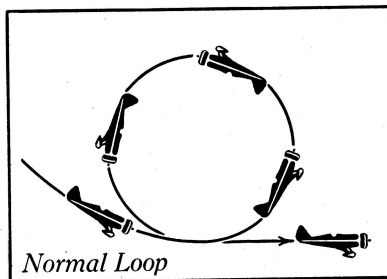
As a last resort, in the case of a flat spin, climb from the back cockpit into the front cockpit and set the stablizer so as to make the ship nose heavy. If the ship is of the open type, try standing up in the cockpit with the arms outstretched. If all this fails — bail out !



The J-5 Wright powered, Straightwing Waco used for the acrobatics described in this report, and the author.

The Loop

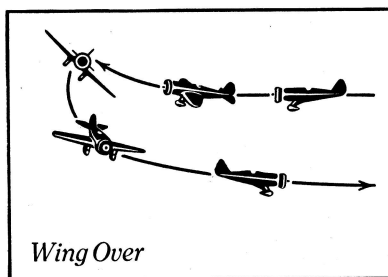
Check the safety belt to see that it is properly fastened; set the stabilizer to make the ship nose heavy; push the control column forward until the ship attains a dive slightly below the horizon; pull back on the control column, and at the same time keep the wings level with the ailerons; keep applying a little more pressure on the control column as you near the top of the loop. At the top of the loop throw the head back in order to sight the ground again; close the throttle all the way as soon as the ground is sighted and then complete the loop by keeping the control column back and easing forward toward the end of the dive to maintain level flight.



To fly a correctly made loop, the pilot should apply just enough pressure on the controls to keep himself firmly in the seat. (Caused by centrifugal force.)

The Wing Over

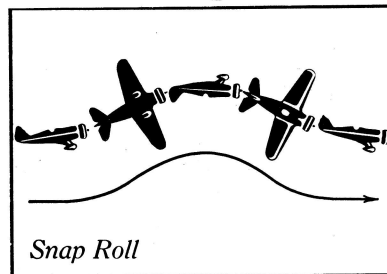
Every pilot seems to have his own pet idea of just how a wing over should be performed, ~~however~~ however the following explanation is my version of a wing over. Proceed to enter this maneuver ⁱⁿ the same manner that was used for the loop. Pull back on the control column until the ship is headed stright up. When in a vertical position, apply a small amount of either right or left rudder, (Which ever direction is desired.) Continue to fly as long as possible until the ship reaches very near a complete stall. At this point the nose of the ship, being heavier than the tail, will drop toward the ground. Allow the ship to dive toward the ground for a short period, and then assume level flight.



The only danger of this maneuver is that the student might try to climb stright up for too long a period, and the result would be a whip stall (Tail slide), which is very hard on the tail assembly of any airplane. To avoid the whip stall, apply a small amount of rudder as the ship is climbing to a vertical position.

The Snap Roll

This maneuver is identically the same as the tail spin with one exception, and that is: The ship will spin horizontally instead of vertically. At cruising speed pull the control column back until the nose of the ship reaches very close to the same angle it would be if it were in a landing position. To perform the snap roll, ~~one must~~ remember to do the following three things as close to the same instant as possible: Close the throttle all the way; pull the control column all the way back; and apply full rudder in the direction the roll is desired. To recover, reverse all the controls and open the throttle.

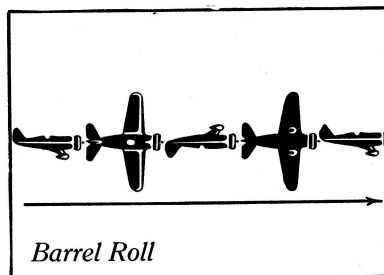


A good way to work up to this maneuver is to practice the tail spin and keep increasing the speed of entry until the ship performs a snap roll. It is very advisable to know the spinning characteristics of any ship before attempting to snap roll. The reason for this is ^{that} there is a very good chance that the ship will go into a flat spin from the snap roll. (See information on the tail spin.)

The Slow Roll

This maneuver is one of the most difficult of all the acrobatic maneuvers. Do not be discouraged if at first you find it impossible to preform. Start this maneuver the same ^{the beginning} as for a loop or a wing over. Before the ship has a chance to lose much of its speed, apply full left or right aileron with the control column slightly back of neutral. The ship will start to roll over on its back. At the completion of a quarter of a turn, the control column should be pushed from the back of neutral position to forward of neutral position. At the completion of half of the roll the control column should be pushed forward until the nose of the ship has reached about the same angle that it had at the beginning of the roll. At the completion of three quarters of the roll the control column should be pulled back to neutral without releasing any of the full aileron which was applied at the beginning. The ship should roll back to normal flight.

Other descriptions have been given in the style of directions. I would preserve the same form in this section. I feel the same point of view.



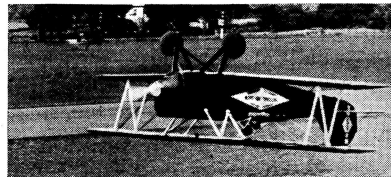
There is one important rule to remember while attempting to preform a slow roll, and that is this:

Never under any circumstances loop out of a slow roll once the ship has reached the inverted position unless the ship is completely stalled first. The reason for this is that the excessive speed might pull the wings off.

If it is found that it is impossible to roll out of the inverted position, then be sure to stall the ship before looping out.

CLEM WHITTENBECK

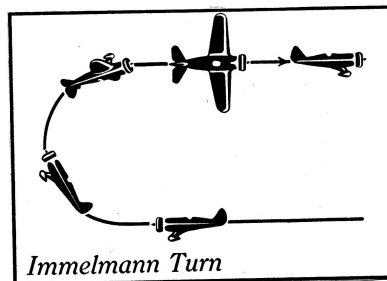
America's No. 1 Inverted Flier



ACROBATIC EXHIBITIONS

The Immelmann Turn

This maneuver is a combination of the loop and the slow roll. Once the slow roll has been mastered, the immelmann turn will be fairly easy to perform. This is another of the maneuvers which is started in the same manner that the loop is started. Fly the ship into a loop, and at the top push forward on the control column to get the nose above the horizon, and at the same time apply full aileron and a small amount of rudder in the direction the roll is desired. When the ship rolls out at the top, ^{that} all _{is} necessary is to neutralize the controls to maintain level flight.



It must be understood that in order to perform this maneuver correctly, ~~that~~ the ship will have to be of the high powered type. It is possible to perform this maneuver with other types of ships, but a considerable amount of dive would have to be incorporated along with it to have enough speed to roll out at the top of the loop.

Aerodynamics of Acrobatic Flying

I wish to point out that there is another important factor to keep in mind while performing any ^{of the} acrobatic maneuvers. This factor that I wish to bring out is the knowledge of knowing how much strain (stress) is being put on the airplane in each maneuver. Acrobatic flying used to be a "cut and try method", but with our present day aeronautical engineers the "cut and try method" has been done away with. At present there is an instrument known as the Gravity Meter which records the amount of load being placed upon an airplane while performing acrobatic maneuvers. With one of these instruments the pilot can tell when he has gone his limit with the particular airplane he is flying. Experiments have shown that the following maneuvers have a dynamic load factor of; 3.5 for the vertical bank without power, 6. for the vertical bank with full power, 4.5 for the immelman turn until the airplane is upside down, 2 to 2.5 until the immelman turn is leveled out again, 3.5 for a correctly made loop, 6. for the incorrectly made loop, 5.5 to 6 for the snap roll, 3.5 for the tail spin, 6. for the tail spin that is improperly performed, and 2 to 2.5 for the normal landing.

The commercially licensed airplane has a safety factor of about six to one, ^{Reference} which means that the commercially licensed airplane can stand a dynamic load factor of about six.

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"EXACT KNOWLEDGE is the BETTER PART of SELF-CONFIDENCE."

F.B. Thompson